

Software Test Plan  
For the  
Human Research Facility  
Muscle Atrophy Research and Exercise System (MARES)  
Workstation Client Software

LS-71090-3

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## ACRONYMS AND ABBREVIATIONS

CSU	Computer Software Unit
CSCI	Computer Software Configuration Item
DC	Direct Current
DR	Discrepancy Report
HRF	Human Research Facility
HRD	Hardware Requirements Document
KB	Kilobytes
MARES	Muscle Atrophy Research and Exercise System
MB	Megabytes
MWC	MARES Workstation Client
PU	Panel Unit
SCSI	Small Computer System Interface
SDD	Software Design Document
SDF	Software Development File
SRS	Software Requirements Specification
STOM	Sub Task Order Manager
STP	Software Test Plan
TBD	To Be Decided
TCP/IP	Transmission Control Protocol/Internet Protocol
TPS	Task Performance Sheet
V	Volts
VDD	Version Description Document

## 1.0 INTRODUCTION

### 1.1 SCOPE

This test plan covers integration and qualification testing for the Muscle Atrophy Research and Exercise System (MARES) Workstation Client CSCI. Specific items to be tested are listed in Table 1.1-1 below.

TABLE 1.1-1 SOFTWARE TEST ARTICLES

Item to be Tested	Test Case Number
MARES Workstation Client CSCI (Integration Test)	1, 2
MARES Workstation Client CSCI (Qualification Test)	1, 2

### 1.2 PERSONNEL

Personnel with skills listed in Table 1.2-1 are required to complete the tests detailed in Section 3.0.

TABLE 1.2-1 TEST AND PERSONNEL TYPES REQUIRED

Test Case Number	Test Type	Skill Type
1-2	Integration Test	Software Tester*
1-2	Qualification Test	Software Tester*, Software Quality Assurance

\*The software tester must have experience with the software environment and be familiar with the CSCI requirements, but should not have been involved in the implementation effort.

For test review and approval authorization, refer to the Science Payloads Department Organization Chart.

## 2.0 REFERENCED DOCUMENTS

- LS-71090-2 Software Requirements Specification for the Human Research Facility Muscle Atrophy Research and Exercise System (MARES) Workstation Client Software
- LS-71090-4 Version Description Document for the Human Research Facility Muscle Atrophy Research and Exercise System (MARES) Workstation Client Software

### 3.0 TEST DEFINITION

The following sections describe each test to be performed including hardware and software setup, detailed test procedures, and expected results. The actual results are documented in the Software Development File (SDF) for unit and integration tests, and on a Task Performance Sheet (TPS) for qualification tests.

Nonconformances identified during integration testing shall be documented in the SDF along with the description of the corrective actions taken. Nonconformances identified during qualification tests shall be documented on a Discrepancy Report (DR). Corrective actions shall be noted on the DR.

A test review meeting shall be conducted prior to the start of formal qualification testing. The details of the test schedule shall be discussed. A test debrief shall be held following the formal qualification testing. The Software Quality Assurance Representative, Sub Task Order Manager (STOM) and HRF Software Lead shall be invited to both the pre-test review and post-test debrief. At a minimum, the Software Quality Assurance Representative and either the STOM or the HRF Software Lead must be present at both meetings. Meeting discussions shall be captured in the SDF.

### 3.1 TEST ENVIRONMENT PREPARATION

#### 3.1.1 Hardware Preparation

Two Commercial Off the Shelf (COTS) computers, two Ethernet hubs, a 28V DC Power Supply, the HRF Workstation 2, and a monitor, keyboard, and mouse, are required to perform Test Case 1. The hardware identification and connections are detailed in Figure 3.1.1-1.

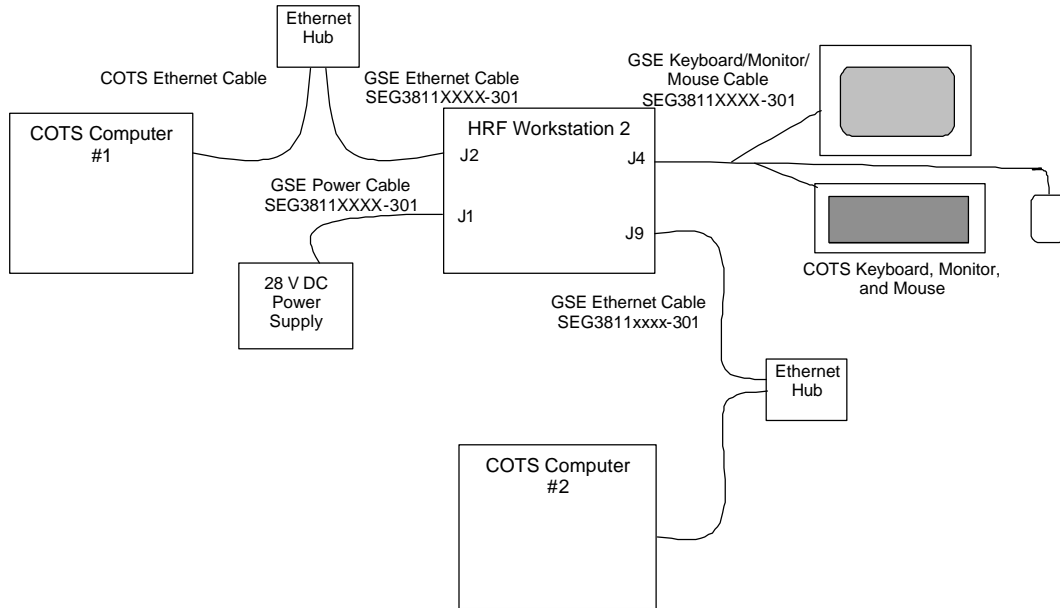


Figure 3.1.1-1 Hardware Test Setup For Test Case 1



A Commercial Off the Shelf (COTS) computer, 28 V DC power supply, Ethernet hub, HRF Workstation 2, HRF MARES Main Box, HRF MARES Pantograph, and the HRF Portable Computer are required to perform Test Case 2. The hardware identification and connections are detailed in Figure 3.1.1-2.

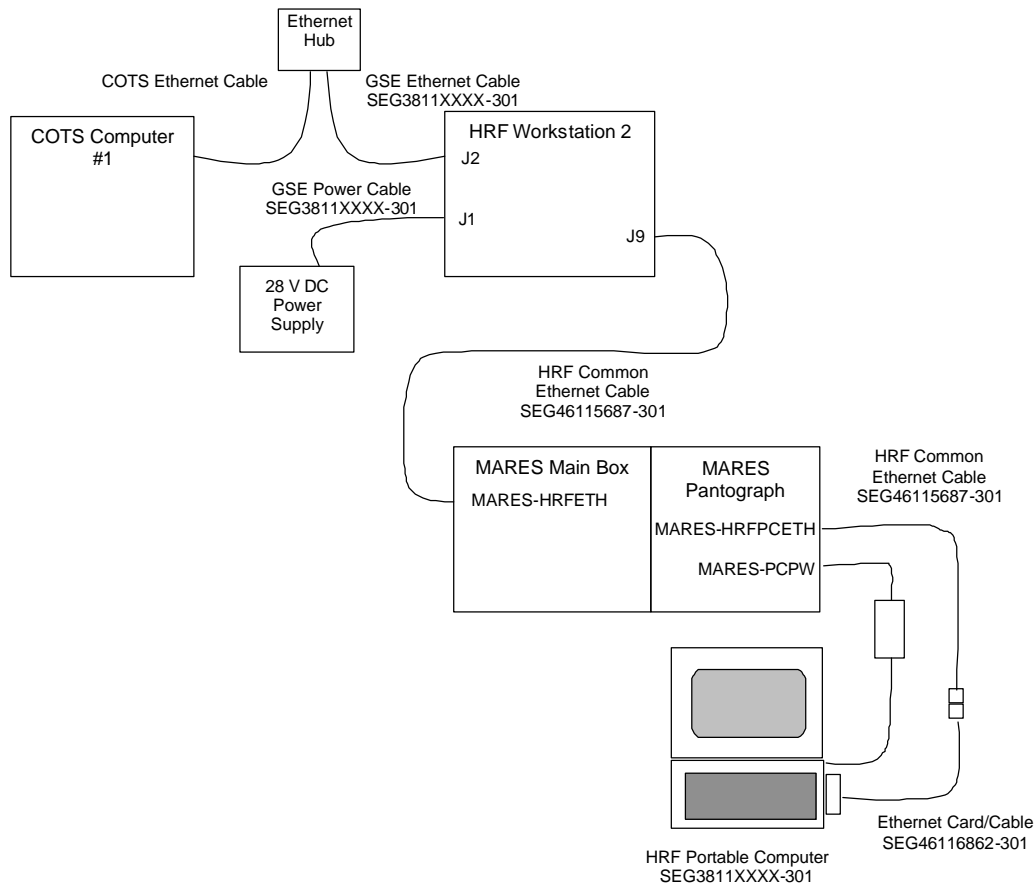


Figure 3.1.1-2 Hardware Test Setup For Test Case 2

The hardware setup of the test environment will remain unchanged during testing, except as called out in the procedure.

### 3.1.2 Software Preparation

The following software should be properly installed on the Portable Computer:

- Windows NT 4.0 Operating System
- PCMCIA Ethernet card driver
- MARES Flight Software

The following software should be properly installed on the MARES Main Computer:

- MARES Flight Operating System
- MARES Flight Software

The following software should be properly installed on the HRF Workstation 2:

- Windows 2000 Operating System
- Ethernet card driver
- Common Software
- MARES Workstation Client CSCI (See Test Case 1)
- MARES Test Viewer (For Test Case 1 only)

The following software should be properly installed on COTS computer #1:

- Windows 2000 Operating System
- Test RIC Software

The following software should be properly installed on COTS computer #2:

- Windows 2000 Operating System
- MARES Test Server Software

The software environment will remain unchanged during testing.

### 3.1.3 Other Pre-Test Preparations

There are no other pre-test preparations.

### 3.1.4 Prerequisite Conditions

No pre-test personnel actions, preparations, training, or procedures are necessary to perform this test.

### 3.1.5 Test Data

The test data for all test cases associated with this test are listed in Table 3.1.5-1. The expected results for each input item are provided for each specific input value.

TABLE 3.1.5-1 MARES WORKSTATION CLIENT CSCI TEST DATA SET

Input Data Item Name	Brief Description	Valid Range	Accuracy Required for Input Value	Input Method	Time Constraints and Other Special Consideration	Specific Input Value(s)	Expected Results
MARES Test Server data file	500 Kbytes of MARES data packets in binary format.	N/A	N/A	file	5 seconds	N/A	Same data will be logged in Test RIC software log file.

### 3.1.6 Criteria For Evaluating Results

The criteria for evaluating requirements shall appear as part of the test procedure in section 3.2. Blank boxes in the “Check” column of the procedure table signify where criteria must be met.

## 3.2 TEST PROCEDURE

Before following the test procedure, a code review shall be held. The SRS requirement 3.3.6 for software safety will be met by inspection at the code review.

### 3.2.1 Integration Tests

The integration tests consist of two test cases. The test cases are designed to test the MARES Workstation Client CSCI, and to demonstrate that it meets the requirements specified in the MARES Workstation Client SRS. For each test case, a detailed test procedure is provided. Section 4.0 contains a cross-reference table for the SRS paragraph numbers of the requirements, and the test case numbers. SRS requirement 3.3.9 a) for consistent results will be met during the integration test by performing the test cases twice with the same initialization data.

### 3.2.1.1 Test Case 1

	Procedure Step	SRS Requirement	Check
1.	Connect the hardware items as shown in Figure 3.1.1-1 Hardware Test Setup For Test Case 1.		
2.	Power on the Workstation 2 and log in as administrator.		
3.	Record the free disk space on the Workstation 2 hard drive before installing the MARES Workstation Client CSCI.  Free Space: _____ MB		
4.	Install the MARES Workstation Client CSCI on the Workstation 2 hard drive. Follow the installation instructions in the VDD, LS-71090-4.		
5.	Record the free disk space on the Workstation 2 hard drive after installing the MARES Workstation Client CSCI.  Free Space: _____ MB		
6.	Compute the disk space used by the MARES Workstation Client CSCI. Subtract the free disk space after installation from the free disk space before installation. Verify that the result is less than 10 MB.  Space Used: _____ MB	3.3.8 b) The MWC CSCI shall utilize a maximum amount of 10 MB of disk space.	
7.	Launch Common Software.		
8.	Launch the MARES Workstation Client software and the MARES Test Viewer.		
9.	Power on COTS computer #1. Log into the operating system and launch the Test RIC software.		
10.	Power on COTS computer #2. Log into the operating system and launch the MARES Test Server software.		
11.	Verify that MARES data packets appear on the MARES Test Viewer screen.	3.3.1 a) The MWC CSCI shall receive experiment data packets,, using TCP/IP protocol.	

	Procedure Step	SRS Requirement	Check
12.	Verify that MARES data appears on the Test RIC screen.	3.3.2 b) The MWC CSCI shall interface with HRF Common software. This external interface shall be used to send real-time MARES experiment data packets to the HRF Common Software.	
13.	Terminate the MARES Test Server software.		
14.	<p>Verify that TBD error code appears in the MARES data shown on the MARES Test Viewer and the Test RIC software.</p> <p>Compare this error code with the documented error code in the VDD, LS- LS-71090-4.</p>	3.3.1 e) The MWC CSCI shall send error codes in the downlinked experiment data packets to signal a Workstation Client to MARES Software connection error.	
15.	Simulate other connection errors that are TBD, and verify the error codes are sent in the data. Verify that these error codes match what is documented in the VDD.		
16.	Open the MARES Workstation Client error log (filename and path are TBD).		

	Procedure Step	SRS Requirement	Check
17.	Verify that connection errors are logged in this file.	3.3.1 f) The MWC CSCi shall log non-fatal errors that occur during execution of the CSCI.	
18.	Locate the Test RIC software log file (filename and path are TBD) on COTS computer #1. Delete or rename the file.		
19.	Locate the MARES Test Server data file (filename and path are TBD) on COTS computer #2. Verify that the filesize is 100 Kbytes.		
20.	Launch the MARES Test Server software while simultaneously starting a stop watch.		
21.	Terminate the MARES Test Server software when the stop watch shows five seconds.		
22.	Locate the Test RIC software log file (filename and path are TBD) on COTS computer #1. Record the filesize below:  Run #1 _____ Kbytes		
23.	Repeat steps 18 – 22 two more times. Record the Test RIC software log file size for each run below:  Run #2 _____ Kbytes Run #3 _____ Kbytes		
24.	Compute the average of the three runs and record below:  Average _____ Kbytes		

	Procedure Step	SRS Requirement	Check
25.	Verify that the Average filesize transferred was 100 Kbytes or greater.	3.3.1 b) The MWC CSCI shall receive experiment data packets with an average throughput of 100 Kbytes/s in 5 seconds.	
26.	Terminate the Test RIC software and power down COTS computer #1.		
27.	Terminate the MARES Test Server software and power down COTS computer #2		
28.	Terminate the MARES Test Viewer and the MARES Workstation Client software and power down the Workstation 2.		
29.	Disconnect the hardware items.	3.3.8 a) The MWC CSCI shall execute in the environment described in the HRF Rack 2 Workstation Interface Definition Document (IDD) (LS-71042-14-4).	

### 3.2.1.2 Test Case 2

	Procedure Step	SRS Requirement	Check
1.	Connect the hardware items as shown in Figure 3.1.1-2 Hardware Test Setup For Test Case 2.		
2.	If not already installed, install the MARES Workstation Client CSCI on the Workstation 2 hard drive. Follow the installation instructions in the VDD, LS-71090-4.		
3.	Power on the Workstation 2 and do not log in.		
4.	Power on the COTS computer and launch the Test RIC software.		



	Procedure Step	SRS Requirement	Check
5.	From the Test RIC software, send the command to start the MARES Workstation Client CSCI. (Steps are TBD)		
6.	Verify that the MARES Workstation Client connection ID appears in the Common Software health and status data.	3.3.1 g) The MWC CSCI shall be capable of being initiated without a user logging into the Operating System. 3.3.2 a) The MWC CSCI shall interface with HRF Common Software. This interface shall be used to initiate the execution of the MWC CSCI without user intervention.	
7.	Configure the MARES for operation: a) Power on the MARES Rack. b) Power on the MARES Main Box. c) Power on the HRF Portable Computer power connector on the MARES. d) Power on the HRF Portable Computer. e) Perform TBD steps to configure the MARES software.		
8.	Have the test subject sit in the MARES pantograph, and start an experiment from the MARES software on the HRF Portable Computer. (Steps are TBD)  Record the experiment ID: _____		

	Procedure Step	SRS Requirement	Check
9.	Verify Workstation 2 connection on the MARES software on the HRF Portable Computer. (Steps are TBD)		
10.	Start an experiment on the MARES and manipulate the MARES hardware, so that data can be collected.		
11.	Verify that MARES data is received on the Test RIC software on the COTS computer.	3.3.1 c) The MWC CSCI shall connect to the MARES software as a single TCP/IP client. 3.3.1 d) The MWC CSCI shall be able to continuously receive experiment data packets from the MARES software after its TCP/IP connection is established. 3.3.1 h) The MWC CSCI shall operate without any user intervention.	
12.	Record the experiment ID associated with the MARES data on the Test RIC software.  Experiment ID: _____		
13.	Verify that the experiment ID recorded in the previous step is the same as the experiment ID from the MARES software.		

	Procedure Step	SRS Requirement	Check
14.	When the experiment is complete, start another experiment on the MARES and manipulate the MARES hardware, so that data can be collected		
15.	Verify that MARES data is received on the Test RIC software on the COTS computer.	3.3.2 c) The MWC CSCI shall interface with the MARES software. This external interface shall be used to receive real-time MARES experiment data packets from the MARES software.	
16.	Record the experiment ID associated with the MARES data on the Test RIC software.  Experiment ID: _____		
17.	Verify that the experiment ID recorded in the previous step is the same as the experiment ID from the MARES software.	3.3.1 k) The MWC CSCI shall connect to Common Software with a different experiment ID for each MARES experiment.	

	Procedure Step	SRS Requirement	Check
18.	<p>View the memory used by the MARES Workstation Client CSCI:</p> <ul style="list-style-type: none"> <li>a) Press Ctrl-Alt-Delete.</li> <li>b) Select "Task Manager".</li> <li>c) Select the "Processes" tab.</li> <li>d) Scroll down to the "MARES_WS_Client.exe" process.</li> <li>e) Record the amount of memory used from the far right column.</li> </ul> <p>Memory Used: _____KB</p> <ul style="list-style-type: none"> <li>f) Verify that the memory used is less than 5 MB.</li> <li>g) Close the Task Manager.</li> </ul>	3.3.8 c) The MWC CSCI shall utilize a maximum amount of 5 MB of Random Access Memory.	
19.	From the Test RIC software, send the command to terminate the MARES Workstation Client CSCI. (Steps are TBD)		
20.	Verify that the MARES data is no longer being received on the Test RIC software on the COTS computer.		
21.	Verify that the MARES Workstation Client connection ID no longer appears in the Common Software health and status data		
22.	From the Test RIC software, send the command to terminate Common Software and to shutdown the operating system. (Steps are TBD)		

	Procedure Step	SRS Requirement	Check
23.	Verify that the Common Software health and status data no longer appear on the Test RIC software.	3.3.1 i) The MWC CSCI shall terminate cleanly when the operating system is shut down. 3.3.2 d) The MWC CSCI shall interface with HRF Common Software. This external interface shall be used to terminate the MWC CSCI without user intervention.	
24.	Power off the Workstation 2.		
25.	Exit the Test RIC software on the COTS computer, shut down the operating system, and power off the computer.		
26.	Shut down the MARES: f) Perform TBD steps to shut down the MARES software g) Power off the HRF Portable Computer. h) Power off the HRF Portable Computer power connector on the MARES. i) Power off the MARES Main Box. j) Power off the MARES Rack.		
27.	Disconnect the hardware items.		

### 3.2.2 Qualification Tests

The Qualification Test is identical to the integration test. Before following the test procedure, all code will be compiled to satisfy SRS requirement 3.3.9 b).

### 3.3 ASSUMPTIONS AND CONSTRAINTS

None.

### 4.0 REQUIREMENTS TRACEABILITY

The Requirements Traceability Matrix is shown in Table 4-1. The Requirements Allocation Matrix is shown in Table 4-2.

TABLE 4-1 REQUIREMENTS TRACEABILITY MATRIX

CSCI Requirement	Test Case	Comment
3.3.1 a)	1	
3.3.1 b)	1	
3.3.1 c)	2	Code review inspection to verify single client connection.
3.3.1 d)	2	
3.3.1 e)	1	VDD inspection to verify error codes
3.3.1 f)	1	
3.3.1 g)	2	
3.3.1 h)	2	
3.3.1 i)	2	Step 23
3.3.1 j)	2	VDD inspection to verify terminate command
3.3.1 k)	2	
3.3.2 a)	2	
3.3.2 b)	1	
3.3.2 c)	2	
3.3.2 d)	2	Step 23
3.3.2.1.1		Verified by SE&I
3.3.2.1.2		Verified by SE&I
3.3.2.1.3		Verified by SE&I
3.3.2.1.4		Verified by SE&I
3.3.5		Satisfied by inspection at Code Review
3.3.6		Satisfied by inspection at Code Review
3.3.8 a)	1	Last step
3.3.8 b)	1	
3.3.8 c)	1	
3.3.9 a)	1 & 2	Satisfied by two test runs during Integration Test with same initialization data.

3.3.9 b)		Code will be compiled on TPS
3.3.10		Satisfied by inspection at Code Review

TABLE 4-2 REQUIREMENTS ALLOCATION MATRIX

Test Case	CSCI Requirement
1	3.3.1 a), 3.3.1 b), 3.3.1 e), 3.3.1 f), 3.3.2 b), 3.3.8 a), 3.3.8 b), 3.3.8 c), 3.3.9 a)
2	3.3.1 c), 3.3.1 d), 3.3.1 g), 3.3.1 h), 3.3.1 i), 3.3.1 j), 3.3.1 k), 3.3.2 a), 3.3.2 c), 3.3.2 d), 3.3.9 a)